

CURRICULUM

A comprehensive curriculum has been developed for the Virtual Reality Station “Elmpact” Virtual Biplane Flight to enable students to learn about aeronautics using highly innovative and very advanced computer-based technologies. The curriculum is designed around a cross country flight. Since a cross country flight takes 5 or more hours and is quite boring except during takeoffs, landings, and special situations, we have chosen to simulate only a portion of the flight.

The cross-country flight curriculum for the VR station provides students with the opportunity to fly a biplane around a small city in a cockpit flight simulator environment. Students follow written directions, observe cockpit instruments (especially the compass and altimeter) and landmarks, and record observations in a pilot’s log.

In the cockpit flight simulator environment, students work in teams of two. One student (the pilot) sits in the cockpit, and another student (the navigator) sits in a chair outside, but next to, the cockpit. Students begin the exercise by reading a set of task cards with instructions on how to operate the simulator and perform the activities. Students are given a pilot’s journal in which to record observations and results in the task cards. The students’ mission is to take off in their aircraft, follow a specific course, and try to land. The navigator reads detailed instructions from the task cards to help the pilot stay on course. The pilot observes the aircraft instruments (especially the compass and the altimeter) to assure that their plane stays on course and does not fly too close to the ground. In addition, the students look for various landmarks (waypoints) along the way to help verify the course. Students have 7 minutes to fly their mission. If they do a good job of staying on course by following instructions and working as a team, 7 minutes will give them enough time to attempt a landing.

Students use a joystick to control the flight path of their aircraft and a throttle to control the speed of their engines. Since the primary purpose of this exercise is to teach students about navigation and teamwork, the aircraft was designed to be easy to fly and maneuver.

Students also have the opportunity to experience a flight around the same city in the immersive virtual environment, where they use a HMD and a joystick. Students are free to turn their heads to look in any direction as they fly their plane using the joystick. They can look over their right or left wing, in front of them at the instrument panel, in back of them at their tail or the terrain they just passed. They can even look down as the terrain passes below them. The purpose of the immersive virtual reality experience is to provide students with a realistic feeling of flying a plane and to demonstrate virtual reality. The curriculum asks students to briefly write about their experiences in immersive virtual reality.

A number of additional features have been built into the software and are accessible by pressing buttons on the control panel on the left side of the cockpit. One button selects how the student/pilot sees the world in front of him. In the COCKPIT mode, the student sees the cockpit instruments in the CENTER display with the out-of-the-window display on the LEFT, CENTER, and RIGHT displays. By pressing the appropriate button, this view can be changed to TRAIL mode, where the student/pilot can see himself trailing his aircraft in the CENTER display with the out-of-the-window display all around him. The TRAIL mode is used to see the results of aircraft maneuvers but is never used in our current curriculum since students have to observe the aircraft instruments during their flight. The TRAIL mode is popular when students are demonstrating the flight simulator during exhibitions.

A number of features were designed into the flight simulator which allow it to be used for remote sensing studies. Another pushbutton selects the display mode of the auxiliary cockpit display. In the MAP mode, a map of the terrain can be seen with an aircraft icon tracking over the map as the student flies the simulator. When the appropriate button is pressed, this mode is changed to CAMERA, where the software simulates a video camera mounted on the lower fuselage of the aircraft. The student/pilot sees the top of the terrain below him. By pressing one of the other "Momentary" pushbuttons, a picture of the terrain visible in the auxiliary display (at the time the button was pressed) will be stored to disk and then printed out on a color printer.

The software is also equipped with a special demonstration mode which enables an attendant or student to record a flight path in either the virtual reality experience or the flight simulator. This recorded path can then be set to automatically play back in either Virtual Reality or Flight Simulator mode to provide true hands-off operation during demonstrations and exhibitions.